Gourmet Trading Company Packaging Inventory Problem

Brian Kitahara and Joshua Vogel
Industrial Technology Department
Orfalea College of Business
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ABSTRACT

With the current trend toward globalization, every company is facing pressure to increase efficiency and reduce costs. A well known cost offender is high levels of inventory, which represents asset value that is not easily liquidated. This is especially true when a company's business model is based primarily on moving high volumes of product between upstream suppliers and downstream customers. Companies using this business model are overly exposed to the costliness of holding excess inventory.

This senior project investigates the cause of high packaging material inventory within a global agricultural importation and distribution business, Gourmet Trading Company. By conducting a series of interviews and inventory analyses, the problem was determined to be a combination of communication issues and lack of a formal forecasting process.

The proposed solution has been developed by the consultants to correct both the issues identified. This solution includes creating an accurate forecast and plans to implement a sales & operations planning system to sustain the forecasting process. The resulting data shows that significant cost reductions can be realized by implementing this solution.

ACKNOWLEDGMENTS

We would like to thank Eric Olsen, Lou Tornatzky, Julia Inestroza, and Gourmet Trading Company for their support in completing this project.

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INTRODUCTION

Problem Statement:

The inventory management system in place at Gourmet Trading Company (GTC) is ineffective in that its packaging and product inventories are not accurately matched. There is typically a large surplus of materials necessary to package and distribute its perishable fruit and vegetable products at its main import locations. These large inventories are costly because it limits the cash available to the company. Brian Kitahara and Joshua Vogel (the consultants) are working on this problem so that the GTC will have more accurate inventory management, which will increase their profitability. It is significant because by not effectively meeting the needs of the organization, the current inventory management system is a non sustainable business practice. Increasing sustainability of business practices promotes long term growth. These deliverable recommendations are designed for use by both production managers and senior management alike.

Needs:

Gourmet Trading Company (GTC) has forecasting, production control, packaging ordering, communication and cost reduction needs. The packaging manager requires more accurate forecasting of demand such that an appropriate amount of packaging is ordered. Control of production requires accurate forecasting and packaging ordering. Communication and the flow of information within the organization needs to be improved. Finally, all these are aimed at the basic need of any organization to reduce its costs. Fig. I below lists and ranks GTC's needs:

	Effectiveness				
Needs	5	4	3	2	1
Forecasting	X				
Production Control			X		
Packaging Ordering		X			
Communication		X			
Reduce Costs	X				

Fig. I Need vs. Importance Table

Background:

Relevant research materials include articles about supply chain management and sale & operations planning. To better understand S& OP we are referencing Wallace's *Sales and Operations Planning, The How to Handbook* and Vollmann, Berry, Whybark, and Jacobs' *Manufacturing Planning and Control for Supply Chain Management*. Another article we examined was Van Wezel's article about planning flexibility in food processing industries provided some good insight into possible causes of bottle necks in this industry.

Potential Solution:

In the early stage of limited information the possible solutions were inherently vague. At a coarse level, improved forecast of demand and supply need to be transmitted to all interested units within the company. Given this information, a detailed, one year sales and operations plan can be created. This plan should include expected supply and demand, as well as re-order points for packaging materials. Further, it would provide recommendations for how to deal with excess supply which is common in agricultural production.

Contribution:

This project contributes directly to GTC's bottom line and increases its business sustainability. Matching supply with demand increases profitability by decreasing wasted resources. Having more accurate forecasts allows more even packaging inventory, which reduces costs. Having more efficient business processes promotes long term sustainability in the market.

Scope of Project:

The scope of this project begins at the broad consulting level of excessive packaging inventory levels, where we play the role of consultants to determine how GTC arrived at such a situation. This is then narrowed down to applying analysis to find the problem in one geographic location. Once the problem is defined, a solution will be created and applied in a theoretical manner.

SECTION II
LITERATURE REVIEW

The purpose of this project is to diagnose the current inventory system and recommend a solution for its improvement. In order to effectively reach this goal, a thorough amount of research is required to understand the concepts of inventory management as they relate to both businesses in general and those in the agricultural sector. By understanding how inventory performance is measured one can begin to objectively rate and monitor its management. Further, understanding the nature of agricultural production allows us to better mitigate the challenges inherent to this business segment. Following these two sections is our recommendation on how best to apply the knowledge of their contents.

To facilitate our research, we split the subjects we covered into two different sections, the first reviewing the broader supply chain management (SCM), and the second responsible for the more concentrated sales and operations planning and demand forecasting.

Supply Chain Management

Stadtler (2005) defines SCM as "the task of integrating organizational units along a supply chain (SC) and coordinating materials, information and financial flows in order to fulfill (ultimate) customer demands with the aim of improving competitiveness of the SC as a whole" (p. 576) Stadtler also presents a house of SCM (Fig. II) to help visualize this definition.

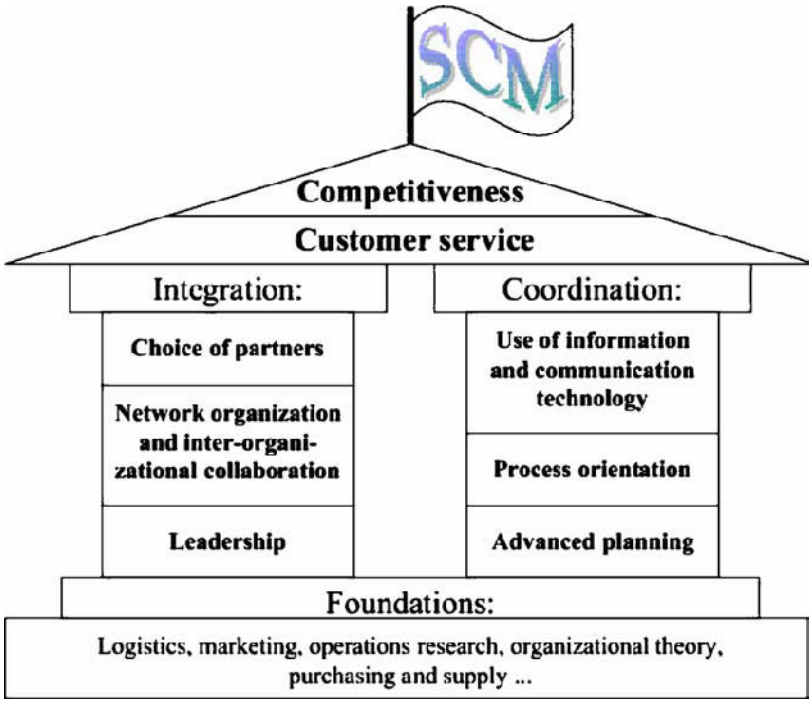


Fig. II House of SCM (as cited in Stadtler, 2002, p. 10)

Stadtler (2005) explains that the roof shows the end goal of SCM which is to" [improve the] competitiveness of a SC...by directing the SC in a sustainable, strategic position compared to its competitors (as cited by Porter 1998)...and customer satisfaction (Christopher 1998)" (p. 577). Stadtler (2005) further explains that the two pillars, 'integration of organizational units' and 'coordination of flows,' support the roof as each are made up of three components (p.577).

The three segments of integration of organizational units are: choice of partners, network of organizations, and leadership. Stadtler (2005) points out that the partners chosen for the supply chain should be chosen based on who fits best with the SC and meets the needs of the customer (p.577). The network of organizations is the best way Stadtler (2005) can describe a supply chain, and that all of these organizations have a common goal without a hierarchical relationship between them (p. 577). The last block, leadership, has two extremes that they can appear as in a SC. One is a focal SC where one partner is the 'natural' leader because of financial power or subject knowledge, (Stadtler, 2005, p. 578). The other is a polycentric network where all partners are treated equally and a committee would make decisions (Stadtler, 2005, p. 578). These

components are all factors which come together to compose the integration pillar of Stadtler's House of SCM.

The coordination pillar is concerned with the usage of information and communication technology, process orientation, and advanced planning (Stadtler, 2005, p. 578). Stadtler (2005) highlights the benefits of today's improved information and communication technology and how it allows "information exchange between partners within instants" and "since information transmission constitutes a part of an order's lead-time its reduction may also restrain the bullwhip effect" (p. 578) Also, Data Warehouses allow access to data throughout the SC in order to aid decision making (Stadtler, 2005, p. 578). The next part, process orientation, will help SC's operate more efficiently because it will allow them to operate focusing on efficiency instead of getting caught on extraneous activities (Stadtler, 2005, p. 578). Lastly, Stadtler (2005) describes advanced planning as an emerging system which is a "successor to enterprise resource planning" which uses hierarchical planning principles (p. 578). Advanced planning covers long-term strategic planning, mid-term master planning, and short-term planning like production, distribution, demand, and purchasing/material requirement planning (Stadtler, 2005, p. 579). The coordination pillar focuses more on just that, coordinating the different parts of the supply chain.

Koh and Saad (2005) conducted a study where they examined uncertainty in Enterprise Resource Planning (ERP) systems in Small and Medium Enterprises (SME). Through their testing, they showed that "poor supplier delivery performance, schedule/work-to-list not controlled, machine capacity shortages, finished product completed--not delivered, unacceptable product quality and engineering design changes during/after production have significant effect on late delivery," (Koh and Saad, 2005, p. 125). Other factors they found to delay delivery of goods were "unacceptable/urgent changes to production schedule and poor supplier delivery performance; and unacceptable product quality and engineering design changes during/after production," (Koh and Saad, 2005, p 125). Fig. III shows the causes' relationship.

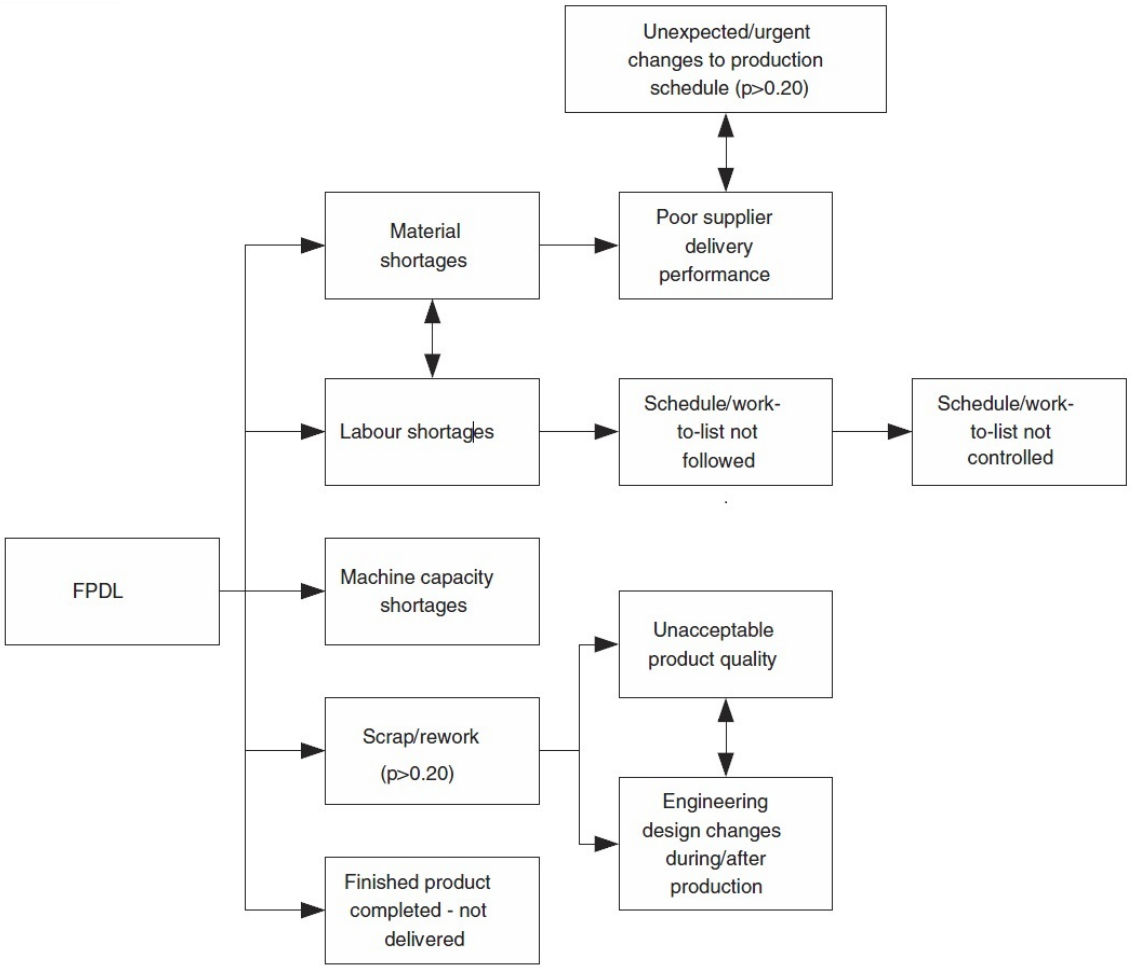


Fig. III Causes of uncertainty and interactions in ERP-controlled manufac. Environ. in SMEs (Koh and Saad, 2006, p. 118).

Liang and Huang (2006) discuss a system where control agents are utilized to share information with a demand forecast agent (p. 395). In this system, the control agents are attached to each part of the supply chain (e.g. supplier, manufacturer, etc…) and communicate with a demand forecast agent who provides feedback informing them of cost and historical demand analysis (Liang and Huang, 2006, (p. 395-396). By using this method Liang and Huang (2005) showed a level of optimization which would allow for greater accuracy in inventory and forecasting as well as reducing the bullwhip effect (p. 405).

Van Wezel, Van Donk, and Gaalman (2006) analyzed planning flexibility in food processing industries (FPI) as a bottleneck (p. 288). Van Wezel et al. (2006) outlined aspects of processing industries which help one to understand the nature of the problem. These factors are: capacity is emphasized more than material management and routing complexity, cleaning times between product families make the production cycle important, the number of customers is small and stable, and lastly key raw materials must often be reserved relatively long in advance (Van Wezel et al. 2006, p.290).

Persona, Battini, Manzini, and Pareschi (2007) looked at finding optimal safety stock levels for manufacturing components. In their literature review Persona et al. (2006) defines safety stock as "an effective management tool for protecting the company against the uncertainty and variability of product demand and raw materials supply" (p. 148). Three different methods are mentioned to determine the best safety stock levels. They are basing safety stock off variation of: demand, forecasting errors, and product structure and standardization (Persona et al. 2006, p. 148). For the purposes of our focus, we will only look at the demand and forecasting error safety stock determinations. When considering variation of demand to base safety stock a normal demand distribution is assumed, and the safety stock level will relate directly to the reorder quantity levels (Persona et al. 2006, p. 149). For the forecasting error based safety stocks, Persona et al. states that safety stock is proportional to forecast errors and should be used when demand is easily predictable (2006, p. 149).

Sales and Operations Planning

According to Vollmann, Berry, Whybark, and Jacobs (2005) sales and operations planning (S&OP) "provides the basis to focus the detailed production resources to achieve the firm's strategic objectives." Meaning that master production schedules (MPS) can be created based off the S&OP and material resources and production capacity can be coordinated as well (Vollmann et al. 2005).

The fundamentals of S&OP are demand, supply, volume and mix (Vollmann et al. 2005). As learned in economics supply and demand are related. Demand exceeding supply means suppliers are unable to keep up with customer demand meaning cost will increase, negatively affecting customer service (Vollmann et al. 2005, p. 61). If supply exceeds demand business is also negatively affected because people will have to be fired to lower production capacity lowering morale and plant efficiency, and rebates and other sales incentives will have to be used to increase sales while lowering profits (Vollmann et al. 2005, p. 61). Balancing demand and supply will help to avoid all these issues. The other factors of volume and mix are separate dealing more with the production side of the equation. Volume has to do with how much of each product family is produced, and mix is what products to make, in what order, and for which customer orders (Vollmann et al. 2005 p. 62). Vollmann et al. (2005) also noted that volume is normally dealt with once a year when the business plan is developed (p. 62). It is also noted that if volume is planned carefully, then the mix will be much easier to deal with (Vollmann et al. 2005, p. 62).

Discussion

Considering the previous works, none of them specifically addressed the needs of Gourmet Trading Company's problem they are experiencing with forecasting demand and how much packaging materials to stock to handle their customer's demand requirements. Several articles discussed background information for different topics which helped to define what was to be dealt with in this project. Based off of these sources it was found to better meet the requirements of GTC, a forecast and system to check the forecast error as well as safety stock level would be developed.

This project will add the application of a forecasting method in the uncertain environment of the agricultural importation and distribution industry. The project Needs are related to previous works in Fig. IV.

	Forecasting	Production Control	Package Ordering	Communication	Reduce Costs
Stadtler	3	2	4	5	3
Koh and Saad	1	4	2	5	2
Liang and Huang	5	3	2	3	3
Van Wezel, et al.	1	3	1	2	1
Persona, et al.	4	2	2	2	3
Vollmann, et al.	3	5	2	3	3

Fig. IV Project Needs Related to Previous Works

SECTION III
METHEDOLOGY

Introduction

As previously stated, an identified problem within Gourmet Trading Company's business processes is an unusually high level of packaging inventory. This is a problem in that high amounts of capital are invested in packaging, hindering the profitability and mobility of the business. The purpose of this project is to act as a consulting firm hired to reduce the levels of high capital inventory.

Initial Analysis and Interviews

In order to reduce the future inventory levels it is necessary to first understand how it arrived at such high quantities. This was done by a succession of interviews with the company contact, Julia Inestroza. These interviews helped create an understanding of how the company operated and determine a small area in which to focus the limited resources of the consulting team.

The first such interview was mostly directed towards understanding the operations of the company as a whole. Here the general operational structure was detailed: GTC partners with farms located in various foreign countries to maintain a constant supply of asparagus and blueberries in its American market. These products are typically packaged in the country of origin in a pack-house owned and operated by either GTC or the farming company. When processed in a foreign located packhouse, the corrugate used comes from a Columbian/Peruvian supplier who does not deal directly with American owned businesses. This further complicates the matter as an expensive third party must act as both purchasing and warehousing agent. Additionally, it was discovered that GTC could reliably predict the quantity of agricultural product that its partner farms produce each season, thus eliminating the need to improve supply forecasts.

The second interview consisted of more detail oriented questions about how the data contained in the inventory spreadsheets related to GTC's operations as well as questions regarding how various businesses processes related to each other. It was determined that the demand for asparagus was driven by an increased supply year round of the product. Every year GTC sells all it's product, rarely having any loss due to lack of sales. However, the one notable exception to this is during American holidays when there are substantial demand spikes for asparagus. It was concluded that the focus of this project should be reducing high capital inventory at the Pasco, Washington location as it has the shortest operational season and therefore the lowest volume. Also, since it is owned and operated 100% by GTC, the greatest benefit of inventory management could be derived from fixing problems in Washington.

The third interview was directed towards understanding how packaging is ordered. This revealed that very little thought or effort was given to ordering the required mix and volume of packaging. The packaging manager, Gabriela Castro, maintains numerous excel spreadsheets containing various forms of data about packaging inventory and usage. It is her responsibility to place the orders for each style of packaging. In order to know how what quantities of each packstyle to order, she asks the sales manager, Brian Miller, what quantities he expects to sell. Historically, Mr. Miller does not take the time to seriously review the demands and is slow to respond with an answer. According to Julia Inestroza, a typical answer is "same as last year." Further, the procurement manager reviews this numerical decision. The organizational culture is to over-order, so by the time the number has seen three separate managers it is substantially inflated.

From analysis of the provided inventory spreadsheets some initial conclusions were reached, some reinforcing finding from the interviews. Firstly, inventory held over from the previous season is not deducted from the quantity ordered for the next season. Secondly, the quantity ordered is often a heavily inflated number not in line with historical trends. This is most evident for the 11-pound black box inventory during the transition between the 2008 and the 2009 growing season. The three-year average for this product category is 142,558 units, yet in 2009 with an empty inventory, the order quantity was one hundred thousand over the average, at 242,000 units. An additional 44,000 units were ordered, bringing the initial season inventory to

286,000 units. The 2009 season was directly in line with the three-year average with the total pack-out quantity being 141,700 units, leaving 144,300 units of 11-pound black box inventory, worth an estimated $95,628. Fortunately there is no direct cost for holding this inventory, as the pack-house is a fixed cost.

Solution #1

The primary solution identified is to implement a sales and operations planning (S&OP) processes. Such a process, as identified in the literature review, involves the integration of demand, supply, volume and mix. It is the upper managements handle on the whole operation. A summary of the current situation is warranted before describing the proposed solution. Supply is a fixed amount in which the farms produce as much as their facilities allow. Demand at the macro-level is inelastic in that downstream customers tend to purchase all the products available. Volume at the macro-level, being pounds of asparagus processed per season, is tied directly to the supply. Mixture of packaging is problematic in that some packaging product families have high quantities of inventory at the ends of seasons while others completely stock out. This problem is due to an inaccurate prediction of volume of demand from each distributor. It is further exacerbated by a lack of inventory level goals and a disjointed organizational culture in which multiple managers each factor in their own personal conception safety stock, leading to highly inflated packaging order quantities.

S&OP Meeting

A monthly S&OP meeting must be held with all the upper management in attendance. The purpose of this meeting is to align the organization's divisions with each other to reach the goals of the business, which in this instance is to increase profitability by reducing packaging inventory. In order for this to work the packaging manager must bring actual packaging data from the most recent month and season, as well as from previous seasons. This includes the amount actually packed for each family of packaging on a per-month and per season basis. Since the focus is on the Pasco, Washington facility, which has a 3-month season, the seasonal totals are sufficient. This data should be processed into a forecast, using one of three methods: moving average, trailing average, or exponential average. The sales manager should come prepared with information regarding projected sales to each distributor based on his communication with the

organization's clientele. Additionally, managers from marketing, finance, and operations should come prepared with any information which may affect sales, such as new product introductions, or changes in supply from a partner farm. Together, with all this information a decision must be made as to the estimated volume of asparagus and the estimated mix of demand from each distributor.

Before the actual S&OP meeting, the sales manager should have access to the data collected by the packaging manager. This can then be used in conjunction with customer knowledge specific to the sales department. It is then the sales and marketing managers' responsibility to create a demand forecast, which also considers things such as: industry dynamics, competition, and economic conditions. This recommended forecast should be shared with all upper management who will attend the S&OP meeting so they can review it and come prepared with any concerns or objections.

During the actual S&OP meeting the managers come to an executive consensus regarding the planned mix. Key people in attendance should include upper management from: sales, marketing, operations, logistics, and finance and human resources. Here any concerns are voiced and any unresolved issues are settled. Once the entire group is in consensus the results should be recorded and disseminated to the organization as quickly as possible.

Moving Average Forecasting

One solution considered was moving average forecasting. This method uses recent history to create a demand curve, which would represent the average demand and this trend would extend to the next time period (Vollmann et. al, 2005, p.32). With this projection, GTC can forecast demand for the next time period. The moving average forecast (MAF)= $\sum$(actual demand)/(number of periods in moving average) (Vollmann et. al, 2005, p. 34). Finding the bias of the moving average forecast is accomplished by $\sum$(actual demand-forecast demand)/(number of periods of data) (Vollmann et. al, 2005, p. 37). To verify the variances of these forecasts, the mean absolute deviation (MAD) would also have to be calculated. This value would be calculated by MAD = $\sum$|actual demand-forecast demand|/(number of periods of data) (Vollmann et. al, 2005, p.38). This value will show the "average error irrespective of whether it's positive or

negative" giving a better picture of how much the forecast is biased (Vollmann et. al, 2005, p. 38). By continuously applying this method to different data sets, aggregated through package, a forecast for demand and how much of each package type should be ordered for each period can be developed.

Beyond this, safety stock levels can be developed accounting for how often GTC stocking out is acceptable. The equation used to derive this value is safety stock = Z(1.25MAD) (Vollmann et. al, 2005, p. 151). The MAD value is the mean absolute deviation, discussed earlier, and the Z is the Z value found from a standard deviation chart depending on the probability of stock out GTC is willing to accept.

MAF Applied

With these equations the MAF, bias, MAD, and a safety stock level become simple to calculate. Taking each of GTC's annual daily packout summaries for the years of 2006, 2007, 2008, and 2009 we have a data set we can use to perform our forecasting. For the purposes of this exercise, each annual summary sheet should be put together into one .xlsx file. The demands for the 11# box components and 28# box components were then aggregated independently of each other, as shown in Fig. V. This is repeated for each year.

	A	B	C	D	E	F	G	H	K	L	M	N	O	P	Q	R
1	**WA. Daily Packout**															
2	*2009*															
3																
4																
5																
6	**Date**	**11# GTC**	**11# G.G.**	**11# grill**	**11# wood**	**13.5#**	**15# wood**	**Tips**	**26.25# G.G.**	**27# Sam's**	**27# Costco**	**28#**	**28# G.G.**	**28# 325gr.**	**28# grill**	**28# Woodhill**
73	6/16/13	3,180									384	1,968	288			
74	6/17/13										384					
75	6/18/13	NO	PACKING													
76	6/19/13	10,260									768	144				
77	6/20/13	1,560									336					
78	6/21/13	851										39				
79	6/26/13															
80	**Total**	**159,546**	**39,553**	**10,487**	**0**	**6,538**	**0**	**0**	**0**	**2,256**	**17,089**	**160,904**	**13,584**	**0**	**0**	**0**
81																
82	Pounds	1,755,006	435,083	115,357	0	88,263	0	0	0	60,912	461,403	4,505,312	380,352	0	0	0
83																
84	**28# Equ.**	**62,679**	**15,539**	**4,120**	**0**	**3,152**	**0**	**0**	**0**	**2,175**	**16,479**	**160,904**	**13,584**	**0**	**0**	**0**
85																
86																
87																
88	11# demand	=SUM(B80+C80+D80+E80)							28# demand	=SUM(N80+O80+P80+Q80+R80)						
89		SUM(number1, [number2], ...)								SUM(number1, [number2], ...)						
90																
91																
92																
93																
94	11#seasonMAF06-08=	155,548							28#seasonalMAF=	157,887						
95	11#bias=	13,509							28#bias=	5,534						
96	11#MAD=	35,041							28#MAD=	18,374						

Fig. V Aggregating 11# and 28# Box Components

After combining each year's boxes, the next step is to create a MAF for 2009 based off of the previous three season's data. This is accomplished by summing the aggregated box component demands for each box and then dividing them by the number of terms whose data is being used. The formula will be similar to this: =('Daily Packout2008'!L86+'Daily Packout2007'!L92)/2. The following figure will show what has been described.

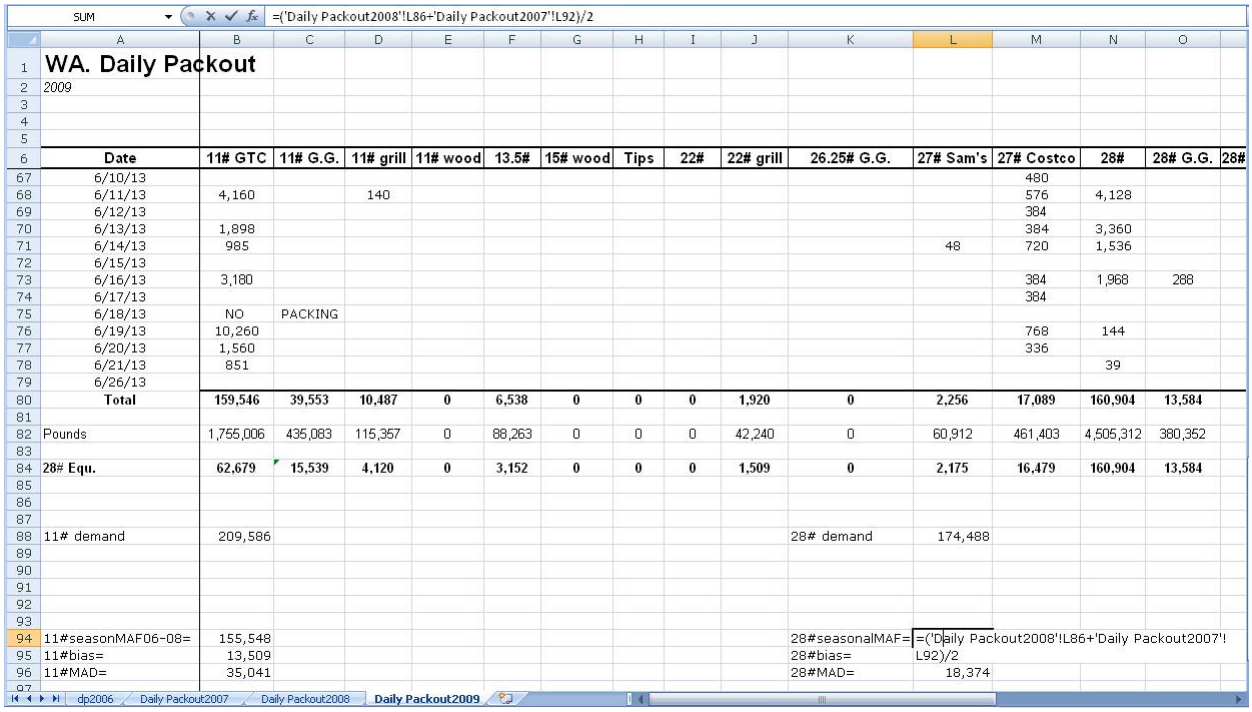
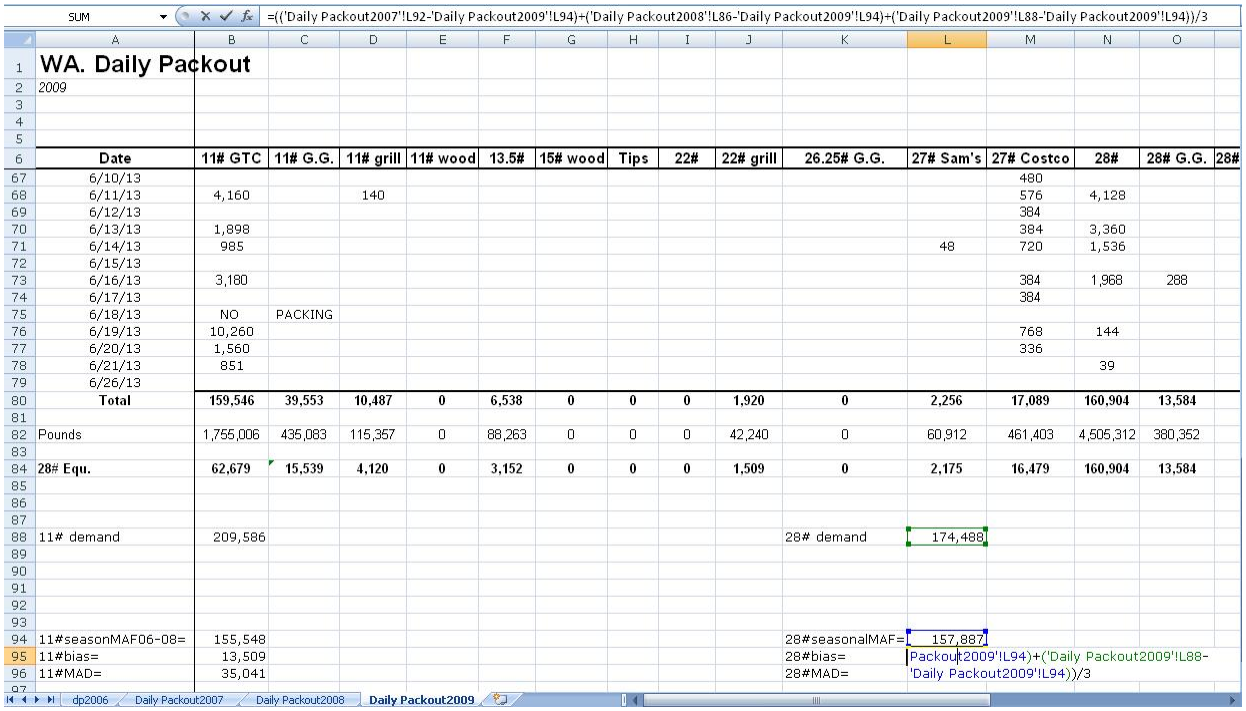


Fig. VI Calculate Box MAF

In order to calculate bias, a method similar to the MAF calculation will be used. This time when you sum the demands, you will subtract the MAF found in the previous section to account for being either over or under inventory for that time period. The excel formulae should resemble this: =('Daily Packout2007'!L92-'Daily Packout2009'!L94)+('Daily Packout2008'!L86-'Daily Packout2009'!L94)+('Daily Packout2009'!L88-'Daily Packout2009'!L94))/3



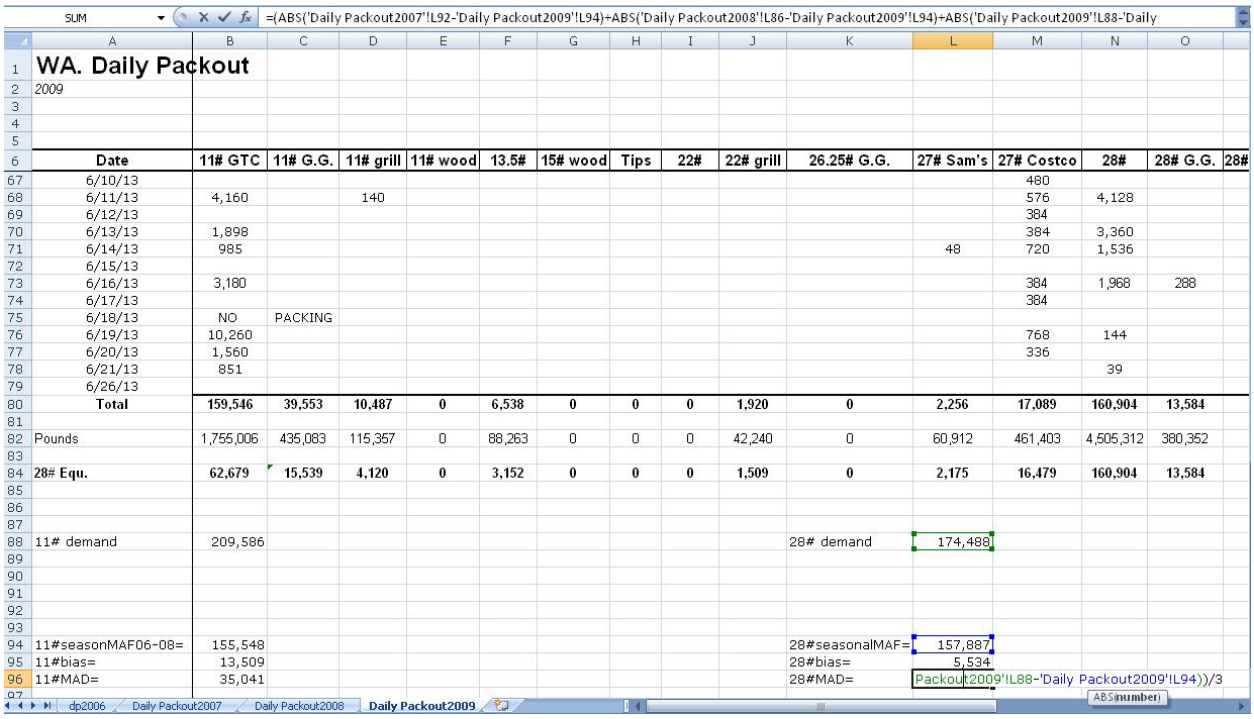
SUM =(('Daily Packout2007'!L92-'Daily Packout2009'!L94)+('Daily Packout2008'!L86-'Daily Packout2009'!L94)+('Daily Packout2009'!L88-'Daily Packout2009'!L94))/3

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	**WA. Daily Packout**														
2	*2009*														
3															
4															
5															
6	**Date**	**11# GTC**	**11# G.G.**	**11# grill**	**11# wood**	**13.5#**	**15# wood**	**Tips**	**22#**	**22# grill**	**26.25# G.G.**	**27# Sam's**	**27# Costco**	**28#**	**28# G.G.**
67	6/10/13												480		
68	6/11/13	4,160		140									576	4,128	
69	6/12/13												384		
70	6/13/13	1,898											384	3,360	
71	6/14/13	985										48	720	1,536	
72	6/15/13														
73	6/16/13	3,180											384	1,968	288
74	6/17/13												384		
75	6/18/13	NO	PACKING												
76	6/19/13	10,260											768	144	
77	6/20/13	1,560											336		
78	6/21/13	851												39	
79	6/26/13														
80	**Total**	**159,546**	**39,553**	**10,487**	**0**	**6,538**	**0**	**0**	**0**	**1,920**	**0**	**2,256**	**17,089**	**160,904**	**13,584**
81															
82	Pounds	1,755,006	435,083	115,357	0	88,263	0	0	0	42,240	0	60,912	461,403	4,505,312	380,352
83															
84	**28# Equ.**	**62,679**	**15,539**	**4,120**	**0**	**3,152**	**0**	**0**	**0**	**1,509**	**0**	**2,175**	**16,479**	**160,904**	**13,584**
85															
86															
87															
88	11# demand	209,586									28# demand	174,488			
89															
90															
91															
92															
93															
94	11#seasonMAF06-08=	155,548									28#seasonalMAF=	157,887			
95	11#bias=	13,509									28#bias=	Packout2009'!L94)+('Daily Packout2009'!L88-			
96	11#MAD=	35,041									28#MAD=	'Daily Packout2009'!L94))/3			
97															

dp2006 | Daily Packout2007 | Daily Packout2008 | **Daily Packout2009**

Fig. VII Calculate Bias

Calculating MAD is similar to finding the bias, for this all you have to do is absolute value the numerator so that the negatives are taken out. This formula will resemble this: =(ABS('Daily Packout2007'!L92-'Daily Packout2009'!L94)+ABS('Daily Packout2008'!L86-'Daily Packout2009'!L94)+ABS('Daily Packout2009'!L88-'Daily Packout2009'!L94))/3



SUM =(ABS('Daily Packout2007'!L92-'Daily Packout2009'!L94)+ABS('Daily Packout2008'!L86-'Daily Packout2009'!L94)+ABS('Daily Packout2009'!L88-'Daily

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	WA. Daily Packout														
2	2009														
3															
4															
5															
6	Date	11# GTC	11# G.G.	11# grill	11# wood	13.5#	15# wood	Tips	22#	22# grill	26.25# G.G.	27# Sam's	27# Costco	28#	28# G.G.	28#
67	6/10/13												480			
68	6/11/13	4,160		140									576	4,128		
69	6/12/13												384			
70	6/13/13	1,898											384	3,360		
71	6/14/13	985										48	720	1,536		
72	6/15/13															
73	6/16/13	3,180											384	1,968	288	
74	6/17/13												384			
75	6/18/13	NO	PACKING													
76	6/19/13	10,260											768	144		
77	6/20/13	1,560											336			
78	6/21/13	851												39		
79	6/26/13															
80	Total	159,546	39,553	10,487	0	6,538	0	0	0	1,920	0	2,256	17,089	160,904	13,584	
81																
82	Pounds	1,755,006	435,083	115,357	0	88,263	0	0	0	42,240	0	60,912	461,403	4,505,312	380,352	
83																
84	28# Equ.	62,679	15,539	4,120	0	3,152	0	0	0	1,509	0	2,175	16,479	160,904	13,584	
85																
86																
87																
88	11# demand	209,586									28# demand	174,488				
89																
90																
91																
92																
93																
94	11#seasonMAF06-08=	155,548									28#seasonalMAF=	157,887				
95	11#bias=	13,509									28#bias=	5,534				
96	11#MAD=	35,041									28#MAD=	Packout2009'!L88-'Daily Packout2009'!L94))/3				
97												ABS(number)				

dp2006 | Daily Packout2007 | Daily Packout2008 | Daily Packout2009

Fig. VIII Calculate MAD

To calculate the safety stock a few decisions must be made. First of all, the safety stock level needs to be decided. Hypothetically, to maintain a 90% safety stock you will use a 0.05 probability of stocking out which has a Z value of 1.645. Therefore, safety stock would be calculated by 1.645(1.25*18,374)= 37,782. Conversely you could take the aggregate demand from 2009, subtract the MAF and back fit it to get a baseline safety stock level to start from.

Solution #2

The second solution identified is a variation of the S&OP concept specifically targeting the sharing of information between supply chain partners. In the current state of operations the customers are kept at an arms distance with very little information sharing. Instead of trying to guess what various customers will order this information should come directly from the customers. A few customers have signed agreements with GTC stating they will require a set quantity of their specifically packaged product. However, the agreements are rarely met and as a result the burden of excess packaging for these customers rests on GTC.

Ideally the customers would record and relay information regarding the sales of asparagus in their stores. Additionally they should have their own forecasting procedures in place, which they use to drive their order quantities. If this information is shared, GTC can make better decisions regarding the mix of distributor packaging.

Solution #3

The third solution is to require contracts with all customers. This is the most drastic solution as it may offend current customers and scare off new potential customers. However, it would be the most beneficial to GTC in mitigating the cost of excessive inventory. In this scenario every distributor is required to sign a contract that either specifies order quantities or stipulates that customers send in order quantities on a timely basis. In either case, the customers must specify in advance how much they will purchase. This information is then compiled by GTC to create an exact distributor packaging mix. It is beneficial to the distributor as they are then guaranteed the amount they specify in their orders. In the event of contract breach there must be provisions.

Provisions for breach of contract incentivizes both parties to uphold their end of the deal. In the event that the distributor does not meet their purchase agreement, they are charged the interest on the cost of packaging inventory not used as a result. Further they can be charged for any other incidental costs that may occur. Should GTC not be able to supply the agreed upon quantity they are charged the sum of lost revenue.

SECTION IV
DISCUSSION AND RESULTS

The purpose of this project is to reduce costs associated with high packaging inventories. The proposed solutions to this problem are implementing monthly sales and operations planning meetings, sharing information between Gourmet Trading Company and its retail and foodservice customers, and seeking contracts which require sales predictions and stricter penalties for deviation from quotes. In this section the proposed solutions are evaluated on both a quantitative and qualitative basis. Then the best solution is chosen and justified. Next, this solution is subjected to a performance evaluation by a faculty member. Finally, the solution is compared to the initial needs identified at the outset of the project.

Evaluation of Solution #1 – Sales & Operations Planning

Implementing a sales and operations plan is advantageous in that it helps upper management gain a handle on the organization's operations. Specifically it forces upper management to consider historical data and use it to forecast future sales. This information is essential for ordering the right amount of packaging. Additionally it creates accountability, as individuals must own their numbers. Historical packaging use data, a responsibility of the packaging manager, must be accurate and up to date. Sales forecasts, a responsibility of the packaging manager, must also be accurate. The team meeting motivates these individuals to put forth their best efforts. Lastly, the presence of the CEO assures that the operations plan is in line with the organization's mission and goals.

Disadvantages of implementing a sales and operations plan are related to its cost and use of time. Every month it requires upper management to take at least an hour out of their busy schedules at the detriment of other obligations. These meetings must be coordinated by an administrative assistant, which requires increased resource utilization. Preparation for the

meetings also requires additional time of managers who must present information (i.e. the sales and packaging managers) at the meeting. Lastly, as a result of these disadvantages, the entire process will meet resistance from management.

Solution #1 23/25	Effectiveness				
Needs	5	4	3	2	1
Forecasting	X				
Production Control		X			
Packaging Ordering	X				
Communication	X				
Reduce Costs		X			

Fig. IX Solution #1 Effectiveness in Addressing Needs

The estimated effectiveness of sales and operations planning is highest of the three proposed solutions. Forecasting is rated five out of five because forecasting is the main output of the monthly S&OP meetings. Production control is rated four out of five because the improved forecast from S&OP helps the production manager allocate the organization's resources more efficiently. Packaging ordering is rated five out of five because the improved forecast from S&OP helps the packaging manager order the correct quantities to meet projected demand. Communication is rated five out of five because the monthly S&OP meetings bring upper management together on a monthly basis. Also, the results of these meetings in disseminated throughout the organization, which fosters communication, among the lower levels, about the planned production goals. Reduced costs is rated four out of five because although it reduces packaging inventory, it requires additional resources to gain this advantage. Overall, the S&OP solution fits the needs to a high degree.

Evaluation of Solution #2 – Intra-organization Information Sharing

Considering GTC's specific pain of high packing inventories associated with their inability to accurately gauge demand from their customers, this solution would directly attack that problem. However, due to the nature of a competitive marketplace, customers may be hesitant to disclose demand information they deem sensitive. This point is punctuated by customers' inconsistency in meeting preset order quantities. To remedy this issue non-disclosure agreements should be included to reassure GTC's clients.

Additionally, with so much information sharing, a large degree of trust between both parties would be required for this solution's success. With that in mind, such a level of trust would foster conditions for GTC to establish prolonged relationships with their customers for future sales as well as being able to expand existing prospects. Regarding the forecasting, whichever solution is chosen, GTC must develop an accurate forecast to determine their packaging needs. Fig. VI shows GTC's needs and how well Solution #2 addresses them.

Solution #2 20/25	Effectiveness				
Needs	5	4	3	2	1
Forecasting		X			
Production Control			X		
Packaging Ordering		X			
Communication	X				
Reduce Costs		X			

Fig. X Solution #2 Effectiveness in Addressing Needs

Solution #2 scored highly in the areas of forecasting, packaging ordering, communication, and cost reduction. Forecasting was assigned a value of four because the solution clearly prioritizes establishing a forecast however this is secondary to building a relationship which emphasizes information sharing. Packaging ordering is also given a value of four because the increased communication of information and any forecasting would allow GTC to order packaging in a more effective manner and address GTC's root problem. Communication scored the highest with a five because the basis of this solution is centered on GTC improving its ability to communicate especially with respect to demand and inventory levels. Cost reduction also scores a four out of five because the overall affect of implementation will result in inventory reduction equaling reduced costs. Solution #2 scored less well in production control. Production control was assigned a value of three out of five because Solution #2 only suggests improving forecasting as a production control tool. The improved communication proposed only deals with communication between GTC and its customers, helping to improve forecasting accuracy. This does not necessarily equate to improved production control.

Evaluation of Solution #3 – Formalized Contracts

The final solution, which deals with creating formalized contracts between GTC and its customers benefits GTC in a few ways. First off, it would create a binding agreement between GTC and its customers with penalties for untimely orders. These penalties would help GTC by encouraging GTC's business partners to communicate better wither GTC and reduce those last minute orders which throw off their packaging inventory. This will also help to ensure the customers get what they order on time. Also for GTC, it will help to improve their forecasting and ability to plan. Disadvantages to this course of action would be that it can make customers feel forced into a relationship with GTC they are not ready to pursue, leading to a discontinued business relationship. This brings up the factor of their customer relationship, and how forcing contracts may strain it unnecessarily.

Solution #3 21/25	Effectiveness				
Needs	5	4	3	2	1
Forecasting	X				
Production Control		X			
Packaging Ordering		X			
Communication		X			
Reduce Costs		X			

Fig. XI Solution #3 Effectiveness in Addressing Needs

This solution scored very well, getting fours and a five in all of the categories as shown in Fig. VII. The five was in the need of forecasting. By having a formal contract with their customers GTC will be able to effectively forecast their demand as well as foresee any variations from their forecasting model and adjust. Production control was given a four because this solution does not address GTC's production directly. Package ordering received a four as well because it will allow GTC to produce a more accurate packaging mix. This contract idea also compels customers to improve their communication with GTC which will help GTC on a business to business level, but not internally. This factor lead communication to only get a four. Finally, cost reduction also receives a four because while overall GTC will reduce costs through lower inventory carrying costs and rush ordering. Though, they may also lose business as a result of this policy, diminishing any cost savings.

Selection of a Solution

A number of methods are used to select the best solution. Using the metrics from the evaluation it is possible to quantitatively compare the proposed solutions to each other. In this manner, the tabulated totals from the evaluations show that solution #1, S&OP, is the highest rated with a total of 23 out of 25 points possible. Solutions #2 and #3 scored totals of 20 and 21 points, respectively. Next, the solutions were sent to the GTC contact, Julia Inestroza, for her evaluation. She indicated that the formalized contracts of solution #3, while good in theory, would prove exceptionally difficult to implement.. Therefore, solution #3 is eliminated from contention. No preference between the first two solutions was expressed, thusly requiring further comparative analysis.

In comparing the remaining two solutions their relevance to the root cause identified must be evaluated. This root cause is lack of communication due to a culture of being too busy. As such, this is an internal problem. On advantage of sales and operations planning is its ability to foster inter-organizational communication by integrating business units. Intra-organizational knowledge sharing is fosters communication between GTC and its customers, which does not solve the internal communication problem. Additionally, intra-organizational knowledge sharing is most effective once strong inter-organizational communication is established. For this reason, it was decided that solution #1, sales and operations planning, is the most valid.

Solution Performance

Upon selection of the sales and operations solution, as survey was created to evaluate its potential effectiveness. The survey contained the effectiveness of needs met rubric used throughout this report. This survey was sent to the GTC contact Julia Inestroza who evaluated the solution. She opined that forecasting demand is inherently difficult but would definitely benefit from implementing a formalized process. Her survey results are shown on the next page along with a comparison to the original needs identified.

Solution #1 20/25	Effectiveness				
Needs	5	4	3	2	1
Forecasting			X		
Production Control		X			
Packaging Ordering		X			
Communication	X				
Reduce Costs		X			

Fig. XII Solution #1 Effectiveness in Addressing Needs According to Julia Inestroza

Original 21/24	Effectiveness				
Needs	5	4	3	2	1
Forecasting	X				
Production Control			X		
Packaging Ordering		X			
Communication		X			
Reduce Costs	X				

Fig. XIII Need vs. Importance Table (Revisited)

Difference	
Forecasting	-2
Production Control	+1
Packaging Ordering	0
Communication	+1
Reduce Costs	-1
Total Difference	-1

Fig. XIV Difference between Original Needs and Theoretical Performance

As shown above, the theoretical performance of this solution closely matches but is not perfectly in line with the original identified needs. There are three possible reasons the needs do not line up perfectly. First, the original needs determined may have been inaccurately valued. Second, the methodology may not have been the most appropriate for the given problem. Third, the industry evaluation conducted may have misjudged the effectiveness of the solution. Since the difference is not drastic, the results are considered mildly successful.

As a part of Solution #1, we went through and calculated the moving average forecast, bias, mean absolute deviation, as well as a couple safety stock levels. Applied to GTC's Pasco annual daily packout reports we found these numbers for the 11# and 28# boxes. Starting with the 11# aggregate demand from 2006-2009 you can calculate the MAF through to safety stock.

MAF = (2006 aggregate demand+ 2007 aggregate demand+ 2008 aggregate demand)/3
MAF = (135,900+132,134+198,611)/3
MAF = 155,548

Bias = [(2006 aggregate demand – 2009 forecast demand) + (2007 aggregate demand – 2009 forecast demand) + (2008 aggregate demand – 2009 forecast demand) + (2009 aggregate demand – 2009 forecast demand)]/4
Bias = [(135,900 – 155,148)+(132,134 – 155,148)+(198,611 – 155,148) + (209,586-155,148)]/4
Bias = 13,509

MAD = [ABS (2006 aggregate demand – 2009 forecast demand) + ABS (2007 aggregate demand – 2009 forecast demand) + ABS (2008 aggregate demand – 2009 forecast demand)]/4
MAD = [ABS(135,900 – 155,148)+ ABS(132,134 – 155,148)+ ABS(198,611 – 155,148) + ABS(209,586-155,148)]/4
MAD = 35,041

Safety Stock(90%) = Z(1.25MAD)
Safety Stock(90%) = 1.645(1.25*35,041)
Safety Stock(90%) = 72,053

Safety Stock(95%) = Z(1.25MAD)
Safety Stock(95%) = 1.96(1.25*35,041)
Safety Stock(95%) = 85,850

Safety Stock (2009) = 11# demand - 11#MAF = Z(1.25MAD)

54,038 = Z(1.25*35,041)

Z = 1.234

This means a 0.39 probability of stocking out, meaning GTC would carry an 80% protected safety stock. Results of these calculations are tabulated in figures xx below. The other table xx shows what would have happened in 2009 if inventory was based on these calculations. Cost per unit is from the Washington ending inventory 09 spreadsheet, which contains records of fluctuating prices. These values are used to complete table xxx. In the column labeled "Actual 09" are real values taken from the 2009 Pasco, Washington daily packout spreadsheet. Inventory cost is calculated by multiplying cost per unit by the ending inventory. For the column labeled 90% protection, the beginning inventory is computed by adding its corresponding value (SS 90%) to the mean average forecast (MAF). This same process is used for the column labeled 95% protection.

Statistic	Value
MAF	155,548
Bias	13,509
MAD	35,041
SS (90%)	72,053
SS (95%)	85,850
SS Exact	54,038
Cost/unit	$0.66

Table I MAF Values, 11# Box

	Actual 09	90% Protection	95% Protection
Beg Inv	356,450	227,601	241,398
Demand	209,586	209,586	209,586
End Inv	146,864	18,015	31,812
% of Use	70.1%	8.6%	13.2%
Inv Cost	$96,930.24	$11,889.90	$20,995.92
Savings		$85,040.34	$75,934.32

Table II Comparison of Safety Stock Levels, 11# Box

As can be seen, the theoretical beginning inventories are much closer to actual demand. This results in significant savings. These figures indicate a safety stock with lower protection would yield even better cost savings with minimal risk of stocking out.

Continuing with the 28# aggregate demand from 2006-2009 you can calculate the MAF through to safety stock.

MAF = (2007 aggregate demand+ 2008 aggregate demand)/2
MAF = (177,147+138,626)/2
MAF = 157,887

Bias = [(2007 aggregate demand – 2009 forecast demand) + (2008 aggregate demand – 2009 forecast demand) + (2009 aggregate demand – 2009 forecast demand)]/3
Bias = [(177,147 – 157,887)+(138,626 – 157,887) +(174,488-157,887)]/3
Bias = 5,543

MAD = [ABS (2007 aggregate demand – 2009 forecast demand) + ABS (2008 aggregate demand – 2009 forecast demand) + ABS(2009 aggregate demand – 2009 forecast demand)]/3
MAD = [ABS(177,147 – 157,887)+ ABS(138,626 – 157,887) +ABS(174,488-157,887)]/3
MAD = 18,374

Safety Stock(90%) = Z(1.25MAD)
Safety Stock(90%) = 1.645(1.25*18,374)
Safety Stock(90%) = 37,782

Safety Stock(95%) = Z(1.25MAD)
Safety Stock(95%) = 1.96(1.25*18,374)
Safety Stock(95%) = 45,016

Safety Stock (2009) = 28# demand - 28#MAF = Z(1.25MAD)

16,601 = Z(1.25*18,374)

Z = 0.723

This means a 0.26 probability of stocking out, meaning GTC would carry a 52% protected safety stock. Results of these calculations are tabulated in Tables III and IV below. The tables were put together in the exact same fashion as those in Tables I and II, but populated with its own respective data.

Statistic	Value
MAF	157,887
Bias	5,543
MAD	18,374
SS (90%)	37,782
SS (95%)	45,016
SS Exact	38,202
Cost/unit	$1.85

Table III MAF Values, 28# Box

	Actual 09	90% Protection	95% Protection
Beg Inv	243,128	195,669	202,903
Use	196,089	196,089	196,089
End Inv	47,039	-420	6,814
% of Use	24.0%	-0.2%	3.5%
Inv Cost	$86,843.40	$0.00	$12,580.01
Savings		$86,843.40	$74,263.40

Table IV Comparison of Safety Stock Levels, 28# Box

As can be seen, the theoretical beginning inventories are much closer to actual demand. This results in significant savings. These figures indicate a safety stock with higher protection is necessary to realize cost savings while still minimizing the risk of stocking out.

SECTION V
CONCLUSION

Summary of Work

This project began as a general attempt to reduce inventory costs for a global agricultural importation and distribution company. Gourmet Trading Company described its operations as having excessive levels of packaging inventory. The researchers conducted a series of interviews to better understand the organizational structure and business processes. These interviews revealed two main issues: lack of communication and inadequate sales forecasting. With this in mind a literature review was conducted in the areas of supply chain management and sales & operations planning. In addition to conducting interviews, the consultants analyzed inventory spreadsheets provided by GTC. This analysis, coupled with further interviews, indicated that potential solutions should focus on improving both the forecast and organizational communication. Three solutions were generated: sales & operations plan (S&OP), intra-organization information sharing, and formalized contracts. Evaluation of the three solutions showed that S&OP was the most comprehensive and effective. In addition to laying out a general framework for conducting S&OP meetings, forecasting for the Pasco pack-house in Washington State was completed. These two deliverables were evaluated for effectiveness by both the consultants and a stakeholder at GTC.

Conclusion

Each of the two main problems showed the importance of well maintained organizational structure and business processes. Gourmet Trading Company's lack of communication highlighted how organizational culture is essential to maintaining a sustainable competitive advantage. Their excessively high inventory showcased the importance of putting thought into sales forecasts. Combined, these two issues exemplified the utility of sales & operations planning.

In its current state, the organization culture within GTC is based on the assumption that every must be overly busy at all times. This is most evident in that its management have trouble communicating with each other effectively. Conversations can last for up to a month, and information requests can take just as long. The most problematic symptom of this culture is high packaging inventory. Two reasons for this were identified: sales quantity creep and insufficient effort in forecasting. First, the sales forecast is typically a "gut feeling" based on how much sales will grow from the previous year. Secondly, the poor communication leads to this number being passed between sales, packaging, and procurement, each of which inflates the number based on their own "gut feelings." Implementing a sales & operations plan resolves both these problems.

A sale & operations planning program provides upper management a tool with which to control the organization. Its implementation requires upper management to acquire information from employees lower in the organization. In doing so, management fosters better communication with its subordinates by conveying the importance of their work. When management conducts monthly S&OP meetings, its members all work together to make the best decisions on how to operate the organization. This too fosters communication as they must get along with each other while working toward the common goal of improved operational efficiency.

Inventory is easily reduced by using the data present in an S&OP meeting to make an informed sales forecast. Using a moving average forecast is a simple calculation with powerful results. With just three years of historical data, it is possible to calculate a packaging inventory amount which will meet the next season's sales demand to any degree of protection desired. The consultants calculated an inventory with safety stock that would accommodate 90% of possible outcomes based on previous years. A theoretical application for the two highest volume and highest cost packages (11lb and 28lb) was created using these numbers. This resulted in an inventory reduction of over 175,000 units and by extensions an estimated $175,000 reduction cost. These savings are for just one short season, low volume pack-house. If applied to the entire corporation this could save the company millions of dollars per year.

Problems

As with any project there were some problems encountered. These include: sheer volume of data on spreadsheets, numbers that did not match between various spreadsheets, highly variable seasons, and the small scope of this project. Each problem was resolved with varying degrees of success.

With at least three separate spreadsheets per season and location there volume of information is overwhelming. Analysis revealed many small errors, such as inventory usage recorded as inventory received. Often times quantities derived on one sheet did not match their counterparts on other sheets. It is entirely possible that these types of mistakes were also made by the consultants.

Seasonality presents a challenge in accurate forecasting. Many factors affecting agricultural supply are unpredictable, such as storms, droughts, infestations, and fires. These events reduce inventory usage to artificially low levels, which can adversely affect sales predictions. These events must be identified and accounted for if forecasts are to be truly accurate. Seasonality also effects which box styles are used, something that was not considered in this report (although it was within its scope).

This leads to the final problem: the limited scope of the project. The Pasco, Washington pack-house has the smallest volume and shortest season in all of GTC's operations. Conclusions drawn for analysis of this location may not by applicable to other portions of the company. The solution proposed has not been theoretically tested with any of the other locations. If more time were allowed, all these problems deserve more attention.

Future Work

Since this project revolves around forecasting, the future is the most exciting consideration. The first step is to apply the forecasting methods described to forecast the current season's sales demand. At the end of the year the actual sales should be compared to the forecast. The actual sales will be close but not perfectly aligned with the forecast. The S&OP team will then have the opportunity to tweak the safety stock protection levels to achieve a better forecast for the next

season. In this season GTC should see significantly lower and more accurate inventory levels. This process is repeated continuously and improves with each consecutive season. Once proven as an effective tool for more accurate forecasts and reducing inventory, S&OP can be applied to the other pack-houses with higher volumes and longer seasons. Here the same process can occur on a larger scale. At this point GTC will realize substantial cost reduction.

SECTION VI
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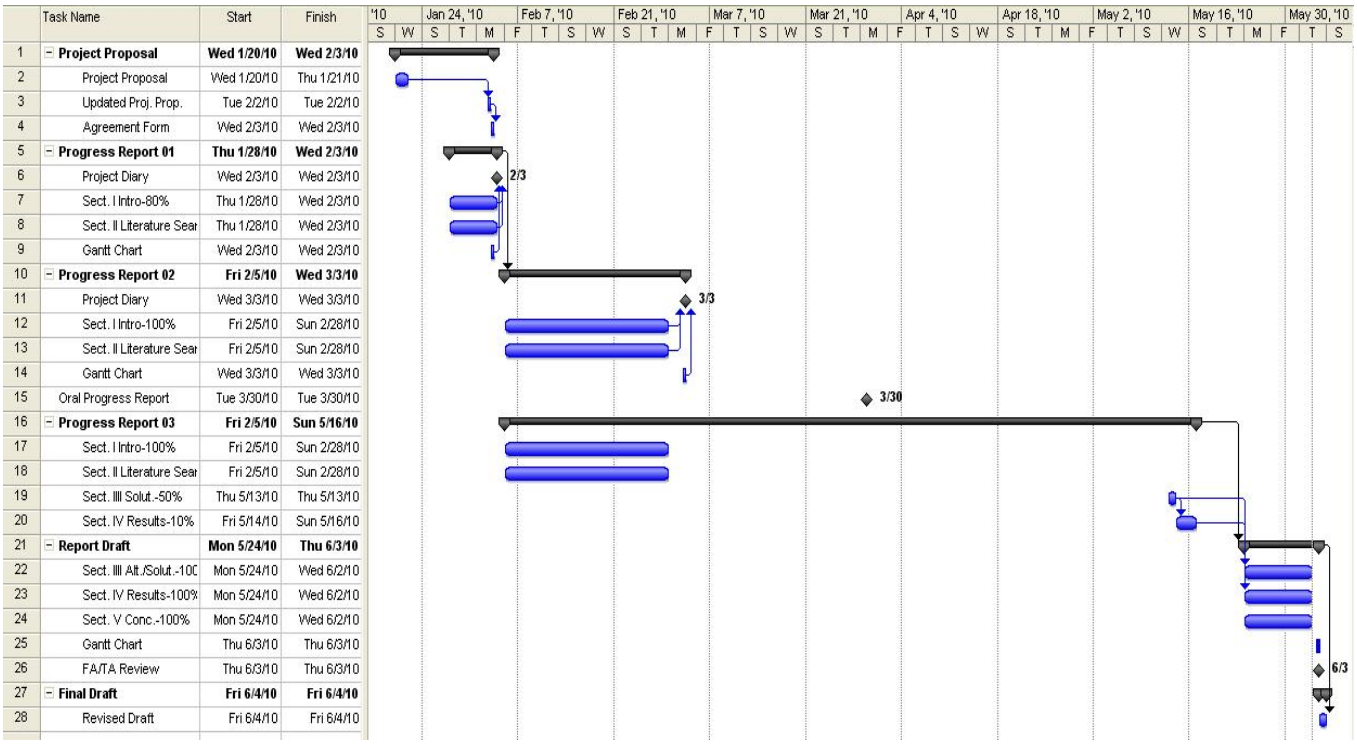
SECTION VII

APPENDICES

Appendix A, Project Progression GANTT Chart:



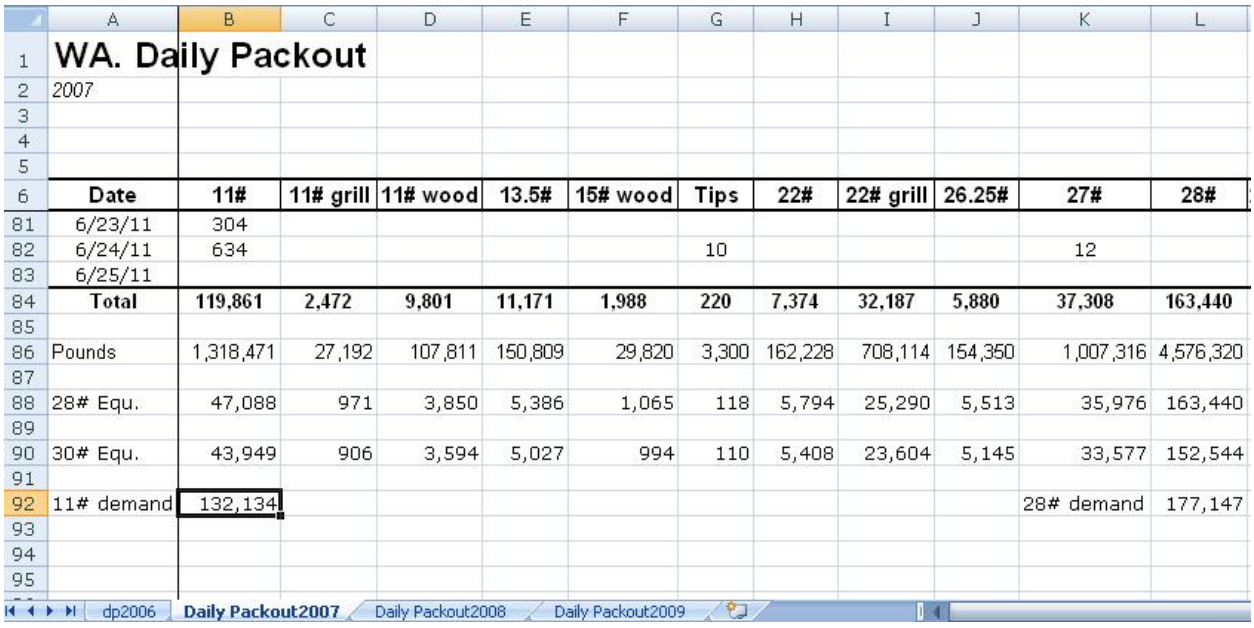
	Task Name	Start	Finish
1	**Project Proposal**	**Wed 1/20/10**	**Wed 2/3/10**
2	Project Proposal	Wed 1/20/10	Thu 1/21/10
3	Updated Proj. Prop.	Tue 2/2/10	Tue 2/2/10
4	Agreement Form	Wed 2/3/10	Wed 2/3/10
5	**Progress Report 01**	**Thu 1/28/10**	**Wed 2/3/10**
6	Project Diary	Wed 2/3/10	Wed 2/3/10
7	Sect. I Intro-80%	Thu 1/28/10	Wed 2/3/10
8	Sect. II Literature Sear	Thu 1/28/10	Wed 2/3/10
9	Gantt Chart	Wed 2/3/10	Wed 2/3/10
10	**Progress Report 02**	**Fri 2/5/10**	**Wed 3/3/10**
11	Project Diary	Wed 3/3/10	Wed 3/3/10
12	Sect. I Intro-100%	Fri 2/5/10	Sun 2/28/10
13	Sect. II Literature Sear	Fri 2/5/10	Sun 2/28/10
14	Gantt Chart	Wed 3/3/10	Wed 3/3/10
15	Oral Progress Report	Tue 3/30/10	Tue 3/30/10
16	**Progress Report 03**	**Fri 2/5/10**	**Sun 5/16/10**
17	Sect. I Intro-100%	Fri 2/5/10	Sun 2/28/10
18	Sect. II Literature Sear	Fri 2/5/10	Sun 2/28/10
19	Sect. III Solut.-50%	Thu 5/13/10	Thu 5/13/10
20	Sect. IV Results-10%	Fri 5/14/10	Sun 5/16/10
21	**Report Draft**	**Mon 5/24/10**	**Thu 6/3/10**
22	Sect. III Alt./Solut.-10(	Mon 5/24/10	Wed 6/2/10
23	Sect. IV Results-100%	Mon 5/24/10	Wed 6/2/10
24	Sect. V Conc.-100%	Mon 5/24/10	Wed 6/2/10
25	Gantt Chart	Thu 6/3/10	Thu 6/3/10
26	FA/TA Review	Thu 6/3/10	Thu 6/3/10
27	**Final Draft**	**Fri 6/4/10**	**Fri 6/4/10**
28	Revised Draft	Fri 6/4/10	Fri 6/4/10

Appendix B, WA 2006 Packout Summary:

	A	B	C	D	E	F
1	**WA packaging summary**					
2	*Season 2006*					
3						
4	**Item**	**Received**	**Used**	**Ending inventory**	11# demand	135,900
5	11# plastic	172,800	117,900	54,900		
6	11# wht ctn	18,000	18,000	0		
7	11# blk ctn	63,117	0	63,117		
8	13.5# large	8,358	7,613	745	28# demand	656,554
9	28# blk top	335,659	301,017	34,642		
10	28# blk bottom	315,249	281,537	33,712		
11	28# wht top	35,000	35,000	0		
12	28# wht bottom	39,000	39,000	0		
13	15# wood	25,600	15,616	9,984		
14	30# wood	31,616	26,752	4,864		
15	#1 used pallets	8,217	8,217	0		
16	New pallets	1,565	539	1,026		
17	Cherry pallets	200	4	196		
18	Pre-cut straps	92	51	41		
19	Poly strap	384	280	104		
20	Carliner paper	50	25	25		
21	Tensionet #3	200	150	50		
22	Staples 5/8	50	16	34		
23	#61 bands	300	13	287		
24	#63 bands	2,592	1,952	640		
25	#85 bands	650	350	300		
26	D.P 12x17	64,000	49,000	15,000		
27	F.P. 10x8-5/8	475,000	254,250	220,750		
28	F.P. 18x8-5/8	374,500	281,500	93,000		
29	Wire .074x.037	34	23	11		
30	Wire .103x.020	44	34	10		
31	Cornerboards	7,020	4,914	2,106		
32	Staples N-15	145	107	38		

dp2006 | Daily Packout2007 | Daily Packout2008 | Daily Packout2009

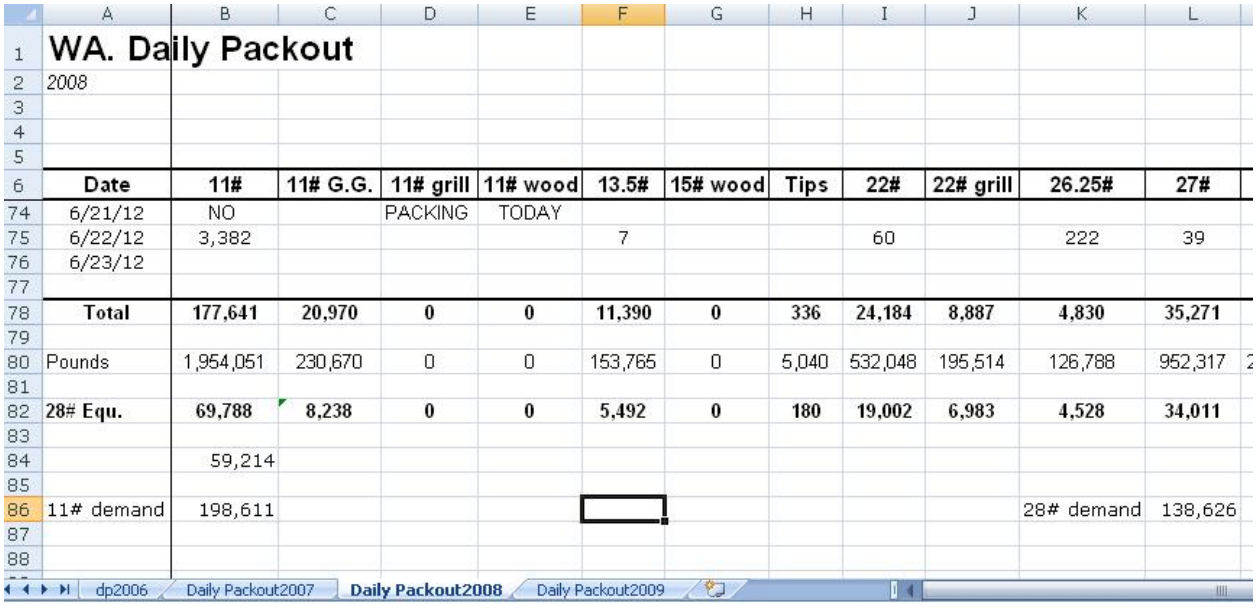
Appendix C, WA 2007 Packout Summary:



	A	B	C	D	E	F	G	H	I	J	K	L
1	**WA. Daily Packout**											
2	*2007*											
3												
4												
5												
6	**Date**	**11#**	**11# grill**	**11# wood**	**13.5#**	**15# wood**	**Tips**	**22#**	**22# grill**	**26.25#**	**27#**	**28#**
81	6/23/11	304										
82	6/24/11	634					10				12	
83	6/25/11											
84	**Total**	**119,861**	**2,472**	**9,801**	**11,171**	**1,988**	**220**	**7,374**	**32,187**	**5,880**	**37,308**	**163,440**
85												
86	Pounds	1,318,471	27,192	107,811	150,809	29,820	3,300	162,228	708,114	154,350	1,007,316	4,576,320
87												
88	28# Equ.	47,088	971	3,850	5,386	1,065	118	5,794	25,290	5,513	35,976	163,440
89												
90	30# Equ.	43,949	906	3,594	5,027	994	110	5,408	23,604	5,145	33,577	152,544
91												
92	11# demand	132,134									28# demand	177,147
93												
94												
95												

dp2006 | **Daily Packout2007** | Daily Packout2008 | Daily Packout2009

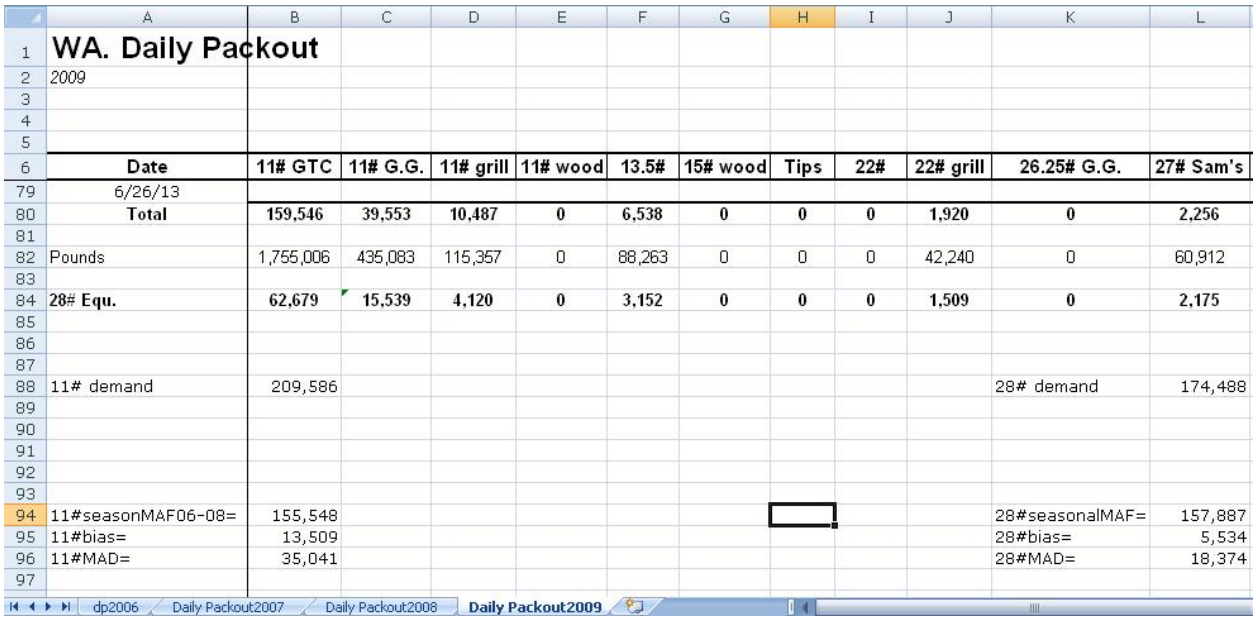
Appendix D, WA 2008 Packout Summary:



	A	B	C	D	E	F	G	H	I	J	K	L
1	**WA. Daily Packout**											
2	*2008*											
3												
4												
5												
6	**Date**	**11#**	**11# G.G.**	**11# grill**	**11# wood**	**13.5#**	**15# wood**	**Tips**	**22#**	**22# grill**	**26.25#**	**27#**
74	6/21/12	NO		PACKING	TODAY							
75	6/22/12	3,382				7			60		222	39
76	6/23/12											
77												
78	**Total**	**177,641**	**20,970**	**0**	**0**	**11,390**	**0**	**336**	**24,184**	**8,887**	**4,830**	**35,271**
79												
80	Pounds	1,954,051	230,670	0	0	153,765	0	5,040	532,048	195,514	126,788	952,317
81												
82	**28# Equ.**	**69,788**	**8,238**	**0**	**0**	**5,492**	**0**	**180**	**19,002**	**6,983**	**4,528**	**34,011**
83												
84		59,214										
85												
86	11# demand	198,611									28# demand	138,626
87												
88												

dp2006 | Daily Packout2007 | **Daily Packout2008** | Daily Packout2009

Appendix E, WA 2009 Packout Summary:



	A	B	C	D	E	F	G	H	I	J	K	L
1	**WA. Daily Packout**											
2	*2009*											
3												
4												
5												
6	**Date**	**11# GTC**	**11# G.G.**	**11# grill**	**11# wood**	**13.5#**	**15# wood**	**Tips**	**22#**	**22# grill**	**26.25# G.G.**	**27# Sam's**
79	6/26/13											
80	**Total**	**159,546**	**39,553**	**10,487**	**0**	**6,538**	**0**	**0**	**0**	**1,920**	**0**	**2,256**
81												
82	Pounds	1,755,006	435,083	115,357	0	88,263	0	0	0	42,240	0	60,912
83												
84	**28# Equ.**	**62,679**	**15,539**	**4,120**	**0**	**3,152**	**0**	**0**	**0**	**1,509**	**0**	**2,175**
85												
86												
87												
88	11# demand	209,586									28# demand	174,488
89												
90												
91												
92												
93												
94	11#seasonMAF06-08=	155,548									28#seasonalMAF=	157,887
95	11#bias=	13,509									28#bias=	5,534
96	11#MAD=	35,041									28#MAD=	18,374
97												

dp2006 | Daily Packout2007 | Daily Packout2008 | **Daily Packout2009**